SM Series Electric Heat Kit

HK050 | HK100 | HK150 | HK200 |

BOSCH

Installation Manual

8 733 904 449 (2013/12)

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INTRODUCTION

Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

Before performing service or maintenance operations on the system, turn off main power to the unit. Electrical shock could cause personal injury or death.

When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing, and place a fire extinguisher close to the work area.

Bosch HK Series Heater Package is a field Installable electric resistance heater kit designed for the SM series heat pumps.

The HK series heater package requires separate electrical service connection, independent from the heat pump's power supply. Hence, installation of this Heater Package will convert SM Series Heat Pump into a two point power connection.

The HK series Heater Package is available in several kW capacities. Unit tonnage vs Heater Package capacity compatibility table is below. (Figure#1)

The HK series Heater Package can be installed on Vertical (VT), Horizontal (HZ) and Counter-flow (CF) units. Eight and ninth character of the SM heat pump signifies the configuration. Example: SM024-1VTC.

Improper installation of the electric resistance heater can result in severe injury or death due to electrical shock or fire.

Only trained and qualified personnel should install, repair, or service this equipment. All electrical service connection to the heater must be done to National and local electrical Standard & codes.

DO NOT wire the heater elements into the same circuit as the compressor.

The SM series HK Series Heater package is designed for installation in the heat pump model published in this document. Do not install this heater kit in a heat pump not specified in this manual.

HK Series Heater Package can only be installed on single phase units

A heater collar is installed in the SM models, no need to order separately.

A heat pump thermostat with supplemental electric heat feature is required to operate the system when this kit is installed.

Figure 1: HEATER COMPATIBILITY

Unit Model	HK050-1201 (5kW)	HK100-1201 (10kW)	HK150-1201 (15kW)	HK200-1201 (20kW)
SM024	X			
SM036	X	X		
SM048	X	X		
SM060	X	X	X	X
SM070	X	X	X	X

x Heater Package Compatibiity

PRE-INSTALLATION

Unpacking and inspection

1. UNPACK the HK heater kit and inspect for contents and condition. If any part or the kit appears damaged (i.e.: broken heater elements, damage relays) or missing, do not attempt to install the kit. Contact your local distributor for further help.
2. Ensure that the heater kit package includes the following components. Contact your local distributor for further help.

Components List

- Pre-wired heater electrical box (including fuses on HK150 and HK200)
- Heater elements
- Heater element(s) protective metal cover
- Wire harness pre-wired at one end .
- New wiring diagram

- Adhesive back electrical data label
- Clear hardware accessory bag containing:
  - Heater element mounting screws (4 for each element bank)
  - Heater element cover mounting screws (2 for each cover)
  - Four electrical box mounting screws
  - Push in wire ties
  - This installation manual

For technical assistance contact your local distributor or Bosch Technical Support:
(954) 776-5471 or
Bosch.Fhp.TechSupport@us.bosch.com.

Required Tools

- Phillips screwdriver
- Small flat head screwdriver
- 5/16” socket and a ratchet or drill
- Wire cutter
- Wire stripper
- Torque Phillips head screwdriver
- Multi meter

ELECTRIC HEAT KIT

The Electric Heat field installed kit contains two main electrical enclosures: Electric Heat Control Box and Electric Heat Elements, both are located in the blower compartment. (Figure#2 through #6)

The control box attaches to the corner post and the heat elements to the blower heater collar in the blower compartment.

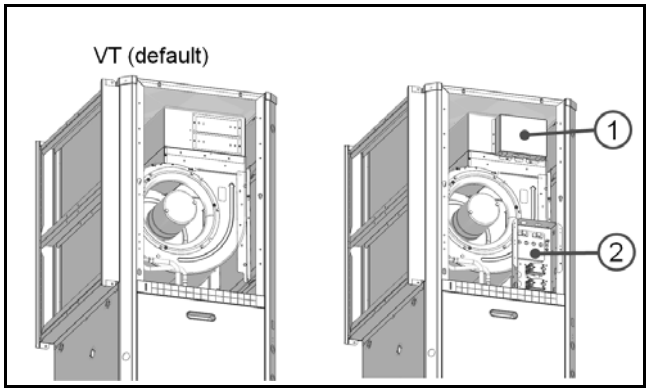

Figure # 2

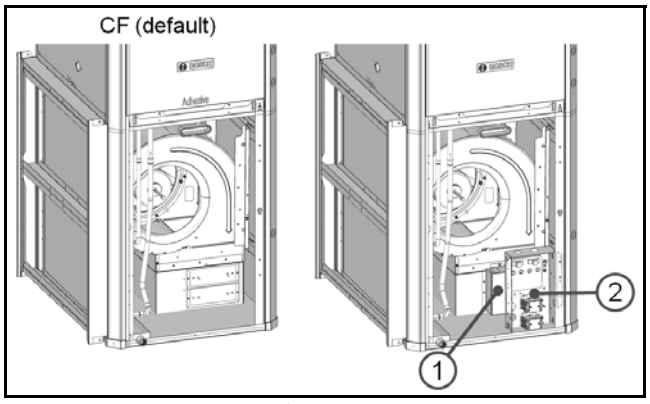

Figure # 3

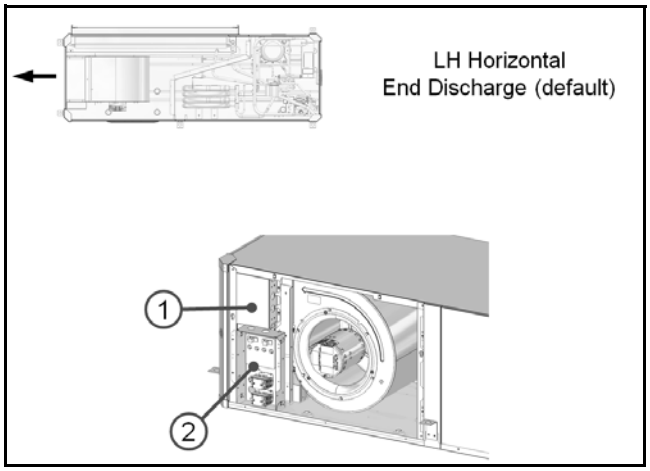

Figure # 4

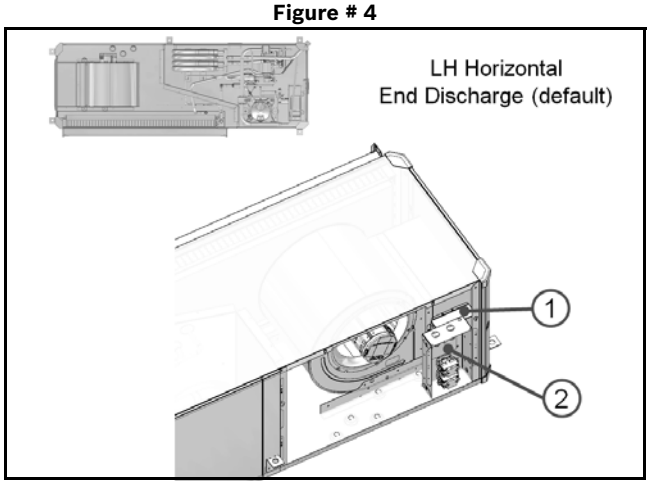

Figure # 5

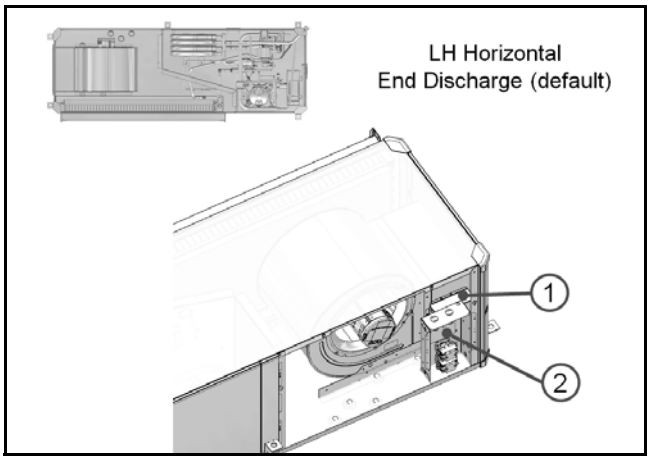

Figure # 6

[1] Heating element cover

[2] Electric Heat control box

INSTALLATION - HARDWARE

1. At Thermostat Turn system to “OFF”
2. Turn the main power to the heat pump to “OFF” at the unit’s disconnect switch or breaker panel.

Follow proper lockout/tag out procedure.

3. Prior to removing the blower panel, disconnect unit display from the back of the panel.(Figure#7)

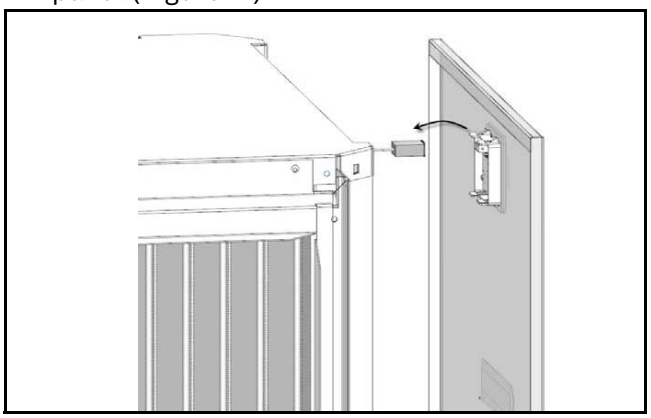

Figure # 7

4. Remove the access panel(s) from the unit exposing the blower section and compressor section of the packaged heat pump unit.
5. Remove the heater collar cover plate(s). (Figure#8)

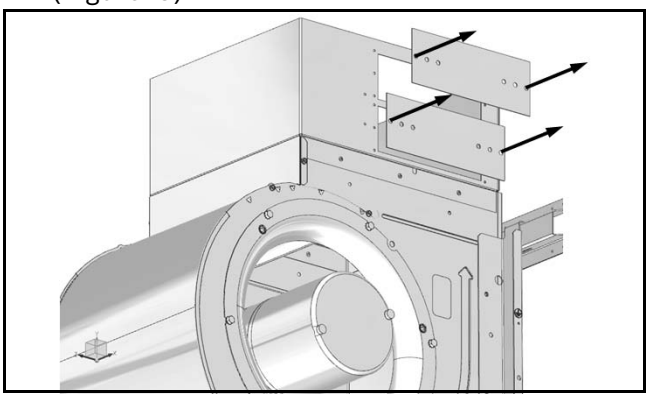

Figure # 8

6. In preparation for heater element installation orient the heating elements with thermal overloads (cutouts) are on the right side for VT & CF and top for HZ.(Figure#9)

Proper Thermal Overloads (cutouts) orientation is required for safe unit operation.

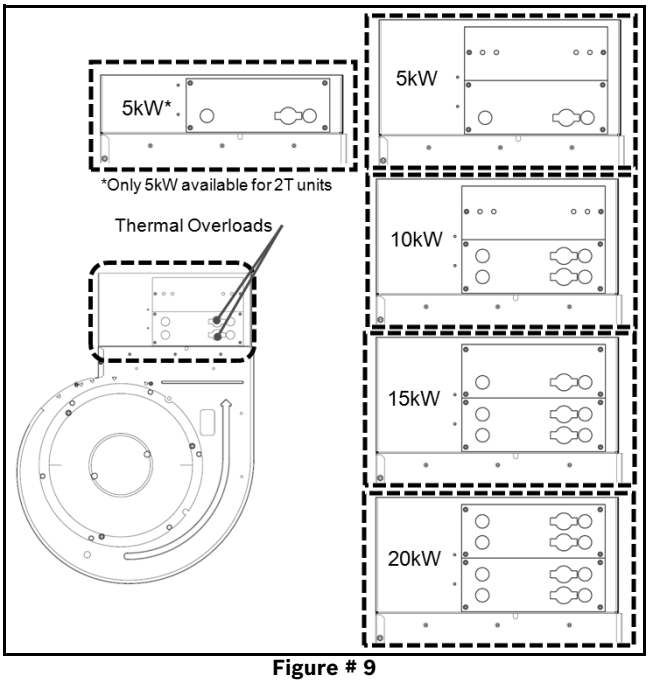

Figure # 9

7. Insert heating element(s) into collar. Heating element rods must be inserted into inner most holes as shown in Figure#10. This will support and prevent vibration of heater elements.

SM060 and SM070 models will have an additional extension bracket mounted on each cover plate. Heating element rods must be aligned to extension brackets accordingly.

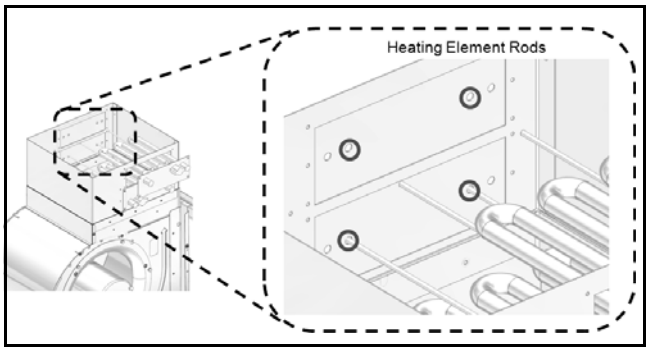

Figure # 10

If only one heating element is being installed, install in into the position closest to the blower wheel. Remaining opening to be covered using (1) of the cover plates removed in step 5.

8. Secure each insert(s) with four of the supplied sheet metal screws (Figure#11).

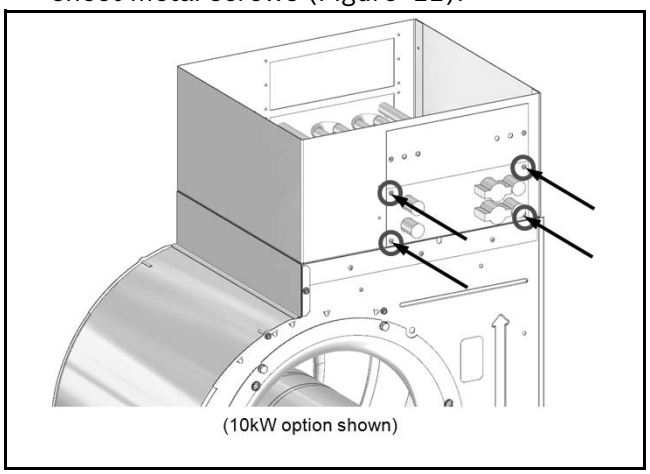

Figure # 11

INSTALLATION - WIRING

There are two Electric Heater control box layouts depending on HK model. (Figures#12 & #13)

HR1 controls Heating Elements 1 and 3 and HR2 controls heating elements 2 and 4.

Refer to wiring diagram on Pg12.

Electric Heater control box is completely pre-wired from the factory.

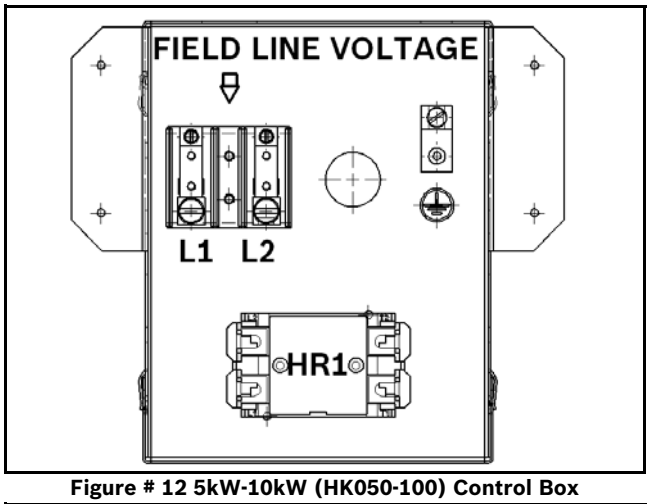

Figure # 12 5kW-10kW (HK050-100) Control Box

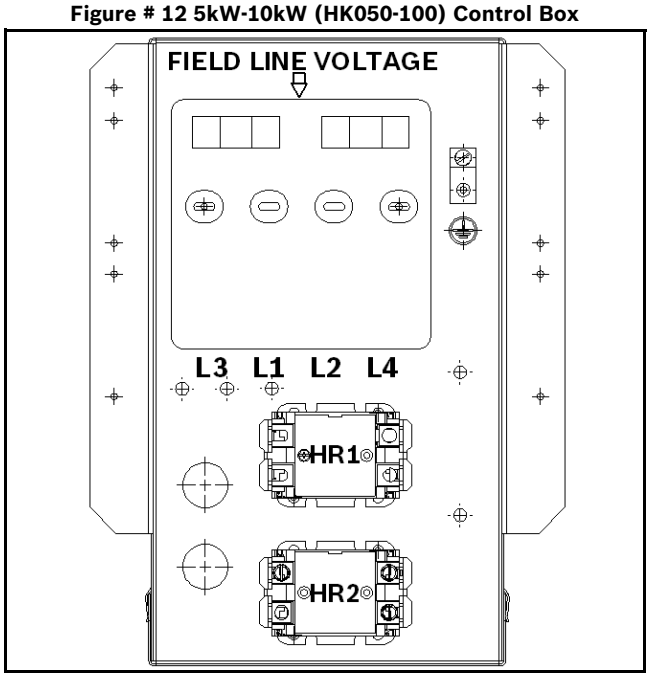

Figure # 13 15kW-20kW (HK150-200) Control Box

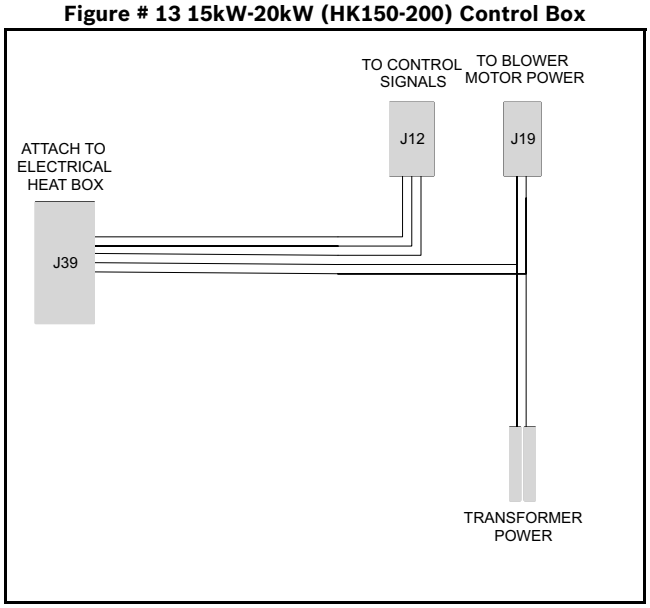

Figure # 14 Electric Heat Harness

1. Route the high voltage Red and Black wires, originating from the Electric Heater control box through grommets in the Electric Heater Element cover as show in Figure#15.

> Route all Red wired together through the same grommet and black wires through the second grommet.

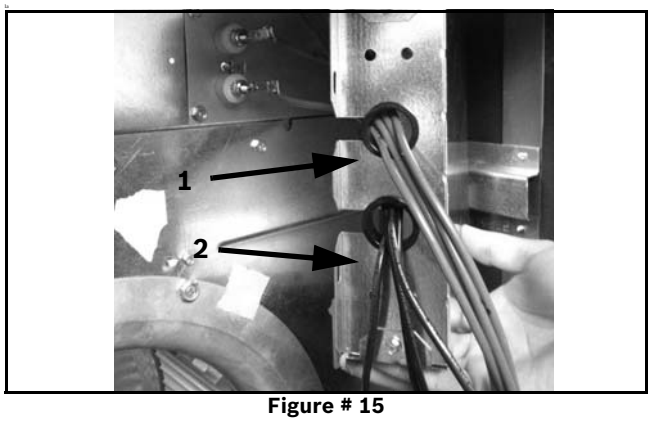

Figure # 15

[1] Red wire

[2] Black wire

2. For Vertical (VT) and Horizontal (HZ) units install the heater control box between the unit corner posts at the bottom of the of the blower section. Counter flow (CF) units install the heater control box between the unit corner posts at the bottom of the of the blower section. (Figure#2 through #6)

> Orient the heater control box with contactor(s) towards the bottom.

> Holes for Control Box are pre-punched in the corner post.

> Ensure no wires are pinched between the metal parts

3. Connect red and black high voltage wires originating from Electric Heater control box to the Electric Heater elements as shown in Figure#17. Terminate Black wires labeled HLS at the thermal limits (cutouts) and Red wires labeled HT at the heater element connections.(Figure#16 &#17)

> Each wire is labeled for ease of identification. Reference wiring diagram on Pg12.

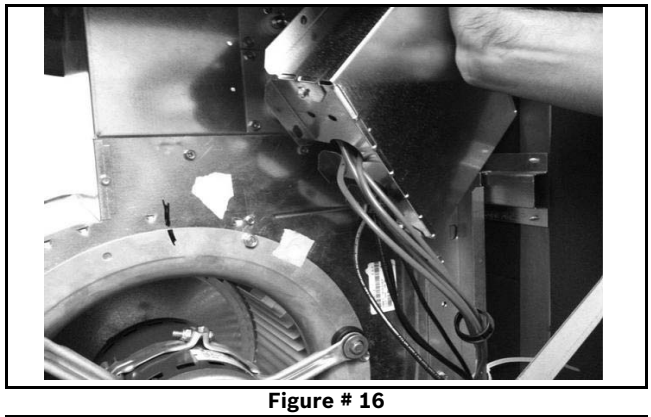

Figure # 16

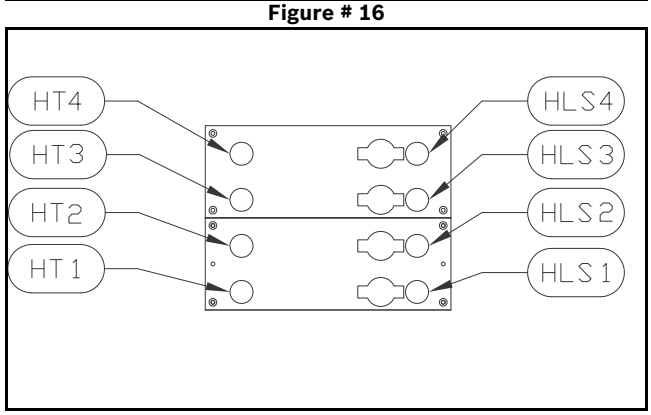

Figure # 17

4. Install the cover for the control box with the provided screws.
5. Remove and retain cork tape covering the hole in the divider panel.
6. On the wiring harness supplied with this kit identify J39 plug. (Figure#18)

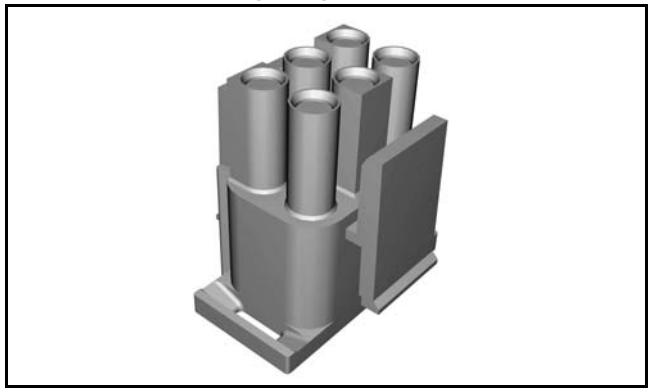

Figure # 18

7. Route J39 plug through the hole in the divider panel and mate the plug to the receiving connector P39 on the side of the electric heat control box.
8. Re-apply cork tape to the divider panel hole.

9. Route the other end of the harness (3 connector end) along the already installed blower harness, and terminate it at the unit electrical box (E-Box). Use tie-wraps every 12-18 inches for a neater finish. (Figure#19- #21)

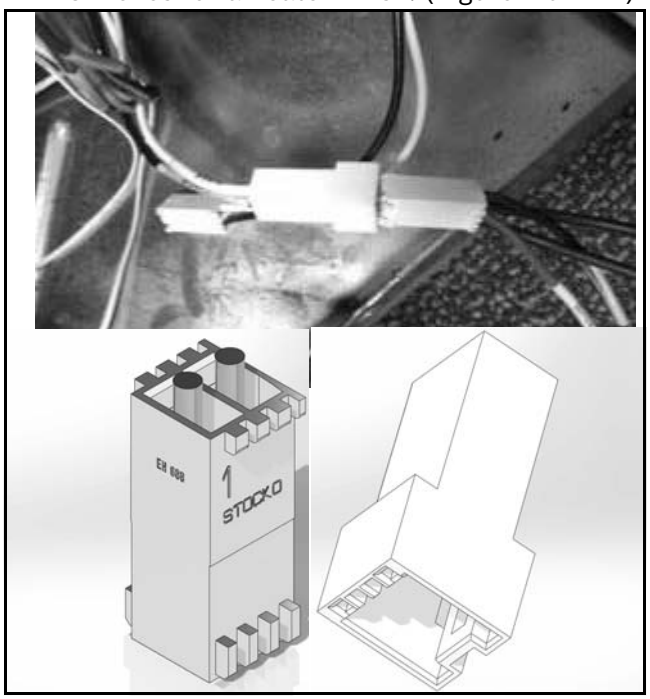

Figure # 19 J19 Blower Power Plug (two position)

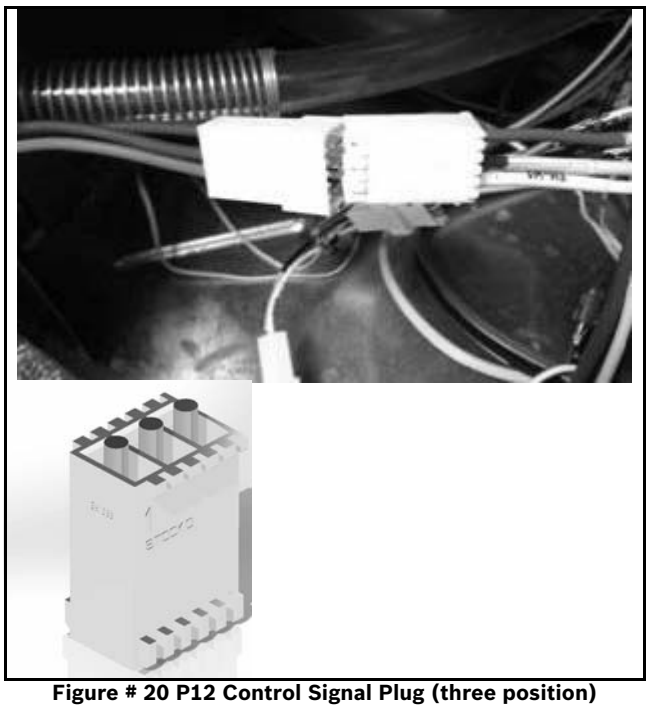

Figure # 20 P12 Control Signal Plug (three position)

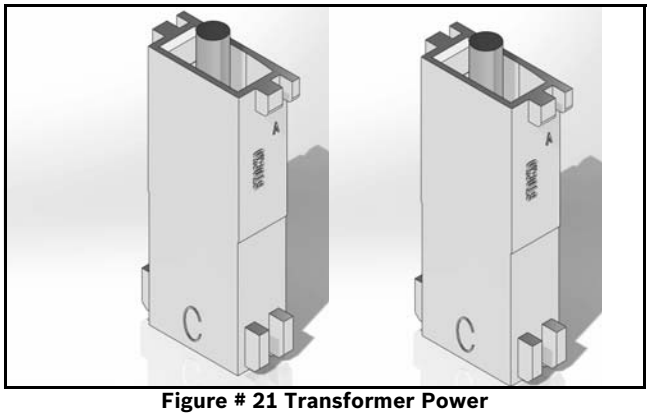

Figure # 21 Transformer Power

10. In the heat pump electrical box, disconnect the J19/P19 high voltage wires that connect the blower motor to the “line voltage” these wires are located on the left hand side of the e-box shown in the picture below.(Figure#22)

Figure # 22

11. Mate J19 plug originating from the electric heat control box (red and black wires) with P19 plug originating from blower harness at E-Box.(Figure#23)

When mating plugs, push both connectors together until they snap with a click.

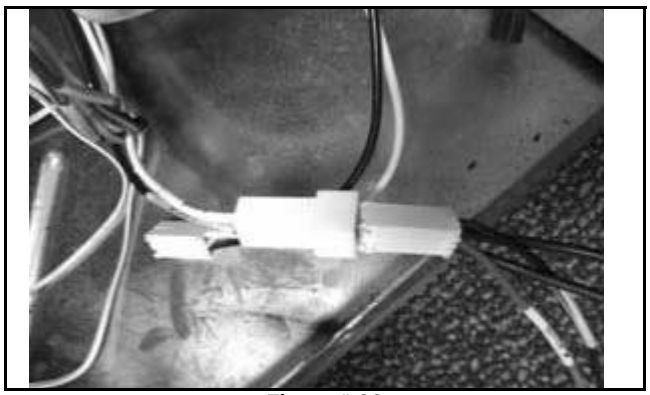

Figure # 23

12. Disconnect the red and black line voltage harness (8733901778) from the transformer primary side and the contactor line side, and remove the harness from the E-box entirely.(Figure#24 & #25)

Figure # 24 Transformer primary

Figure # 25 Primary disconnected

13. Route the two line voltage wires that derived from the P19 plug, these wires should be routed under the contactor along the bottom of the electrical box.(Figure#26)

When routing wiring avoid sharp edges as these can chafe wiring insulation, exposing the conductor. This can result in equipment damage and personal injury.

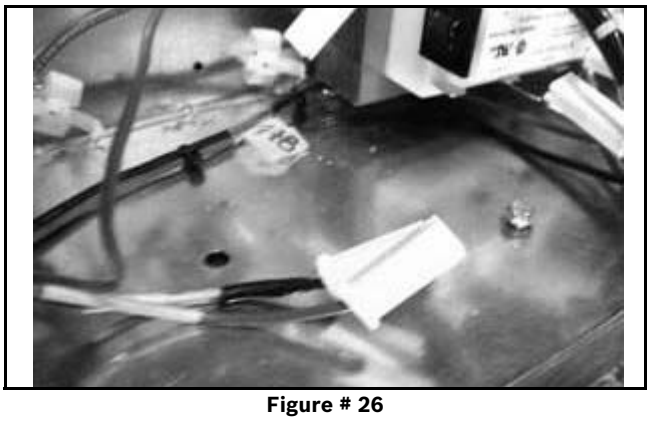

Figure # 26

14. Connect red and black wires from electric heat harness to transformer primary winding per wire labels.
15. There will be one harness (black and white wires) left connected to the compressor contactor. Remove and discard this loose harness from the contactor.(Figure#27)

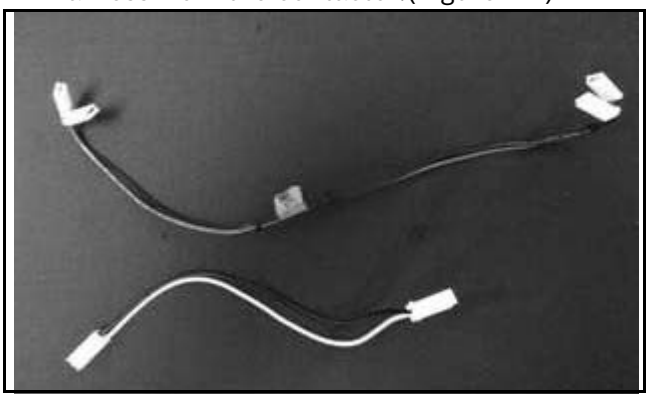

Figure # 27

16. There should now be one plug left labeled P12 on the electric heat harness. Mate this plug to its counterpart plug already available on the left hand side of the e-box labeled J12.(Figure#28 & #29)

Figure # 28

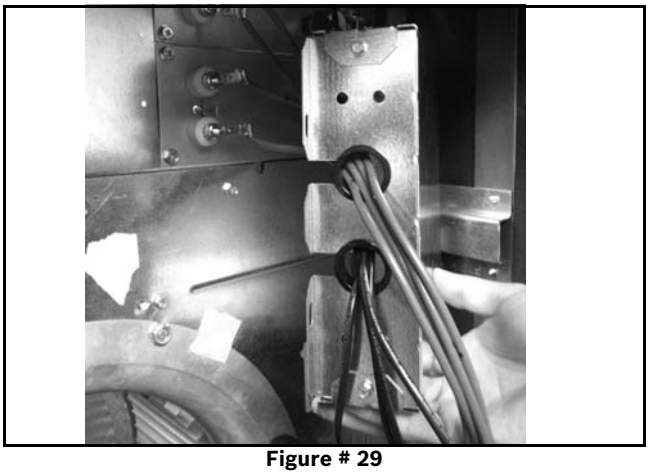

Figure # 29

17. Ensure heater element wires are routed through the plastic bushings available in the kit, and perform a continuity test to ensure all connections are secure.

> Use bottom holes on the plate to inset the plastic grommets and prevent the wires from laying on sharp edges

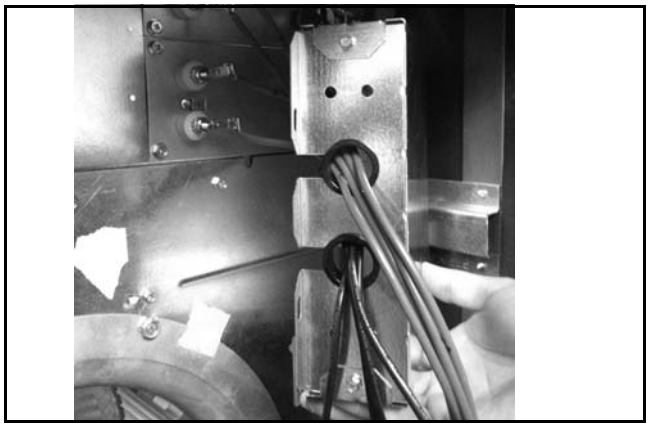

Figure # 30

18. Remove (2) screws as shown. (Figure#31)

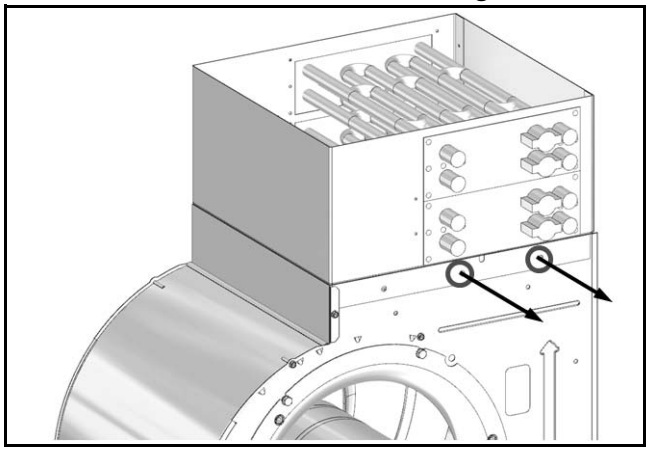

Figure # 31

19. Mount Heater Element cover to blower collar using (4) screws. (Figure#32)

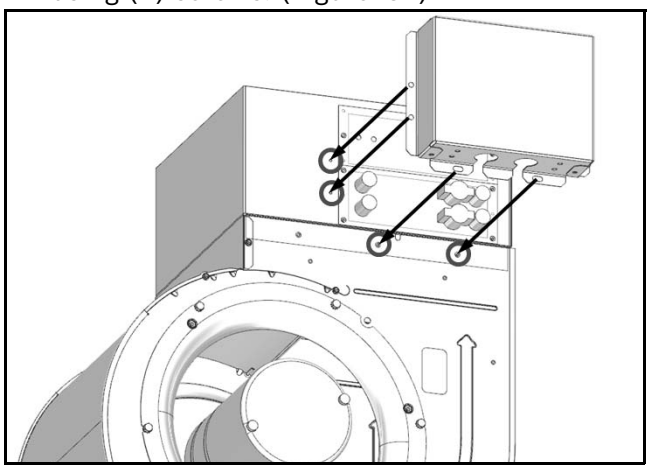

Figure # 32

20. Use push in wire ties to secure cables to cover and blower bracket.(Figure#33)

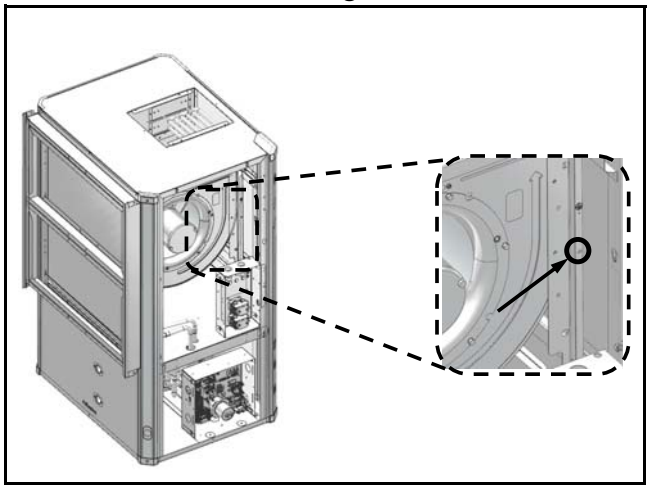

Figure # 33

THERMOSTAT WIRE CONNECTIONS

1. Assure that two low voltage wires are available from the thermostat to make the “W1” and “EM” connections. If these wires are not located, they will need to be pulled and routed from the back of the thermostat to main thermostat connections on the electrical box or to the motor control board.

2. Strip the insulation off of the “W1” and “EM” wires and insert into the thermostat control wire block or on the motor control board thermostat interface. Connect the other end of the wires to the back of the thermostat to the supplemental and emergency heat terminals. **Reference the Thermostat User’s Manual for proper connection.**

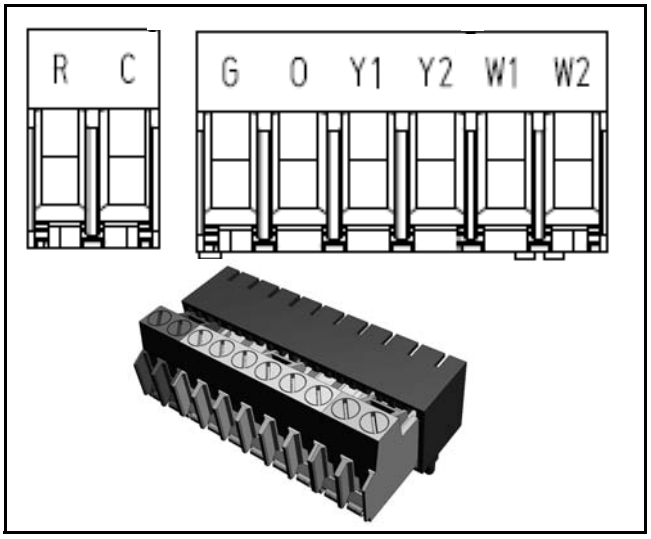

Figure # 34

SITE LINE VOLTAGE CONNECTION

Routing New Line Voltage Wires
From Circuit Breaker Panel To Heater
Electrical Box

1. Select the proper wire size based upon the heater electrical load that the blower motor and electric heater element(s) will require. Refer to the data tag label that is included in the heater kit or the electrical data at the end of this manual. Ensure that all national and local electrical codes are followed for installation, wire sizing, and breaker sizing.
2. Select the proper breaker size based upon the heater electrical load that the heat pump will require. Refer to the data tag label that is included in the heater kit or the electrical data at the end of this manual.
3. Route the new line voltage wiring and the ground wire from the circuit breaker panel to the heat pump.
4. Use the knockout provided in the heat pump corner post as the entry for the electrical service wiring. A plastic bushing should be used to protect the wire insulation from the metal edge of the knockout
5. Connect one of the line voltage wires to **“L1”** terminal connection and the other line voltage wire to **“L2”** terminal connection. Torque to 22 in-lbs.
6. Use the ground lug provided in the heater control box to connect the field ground from the power supply.

WIRING DIAGRAM REPLACEMENT

1. Remove the wiring diagram that is adhered to the back side of the front panel. Replace with the wiring diagram that was included with the heater kit. Using spray adhesive glue is recommended.
2. Place the adhesive back heater data label next to the knockout in the post where the new electrical service for the fan motor and heater elements is entering the cabinet.

UNIT START UP

1. Turn the disconnect switch or breaker switch to the “ON” position for the compressor and for the new separate circuit servicing the blower motor and the heating elements.
2. Run the unit in heating mode with the heating elements engaged for at least 10 minutes to ensure the unit does not shut down due to any temperature limiting device.

WIRING DIAGRAM

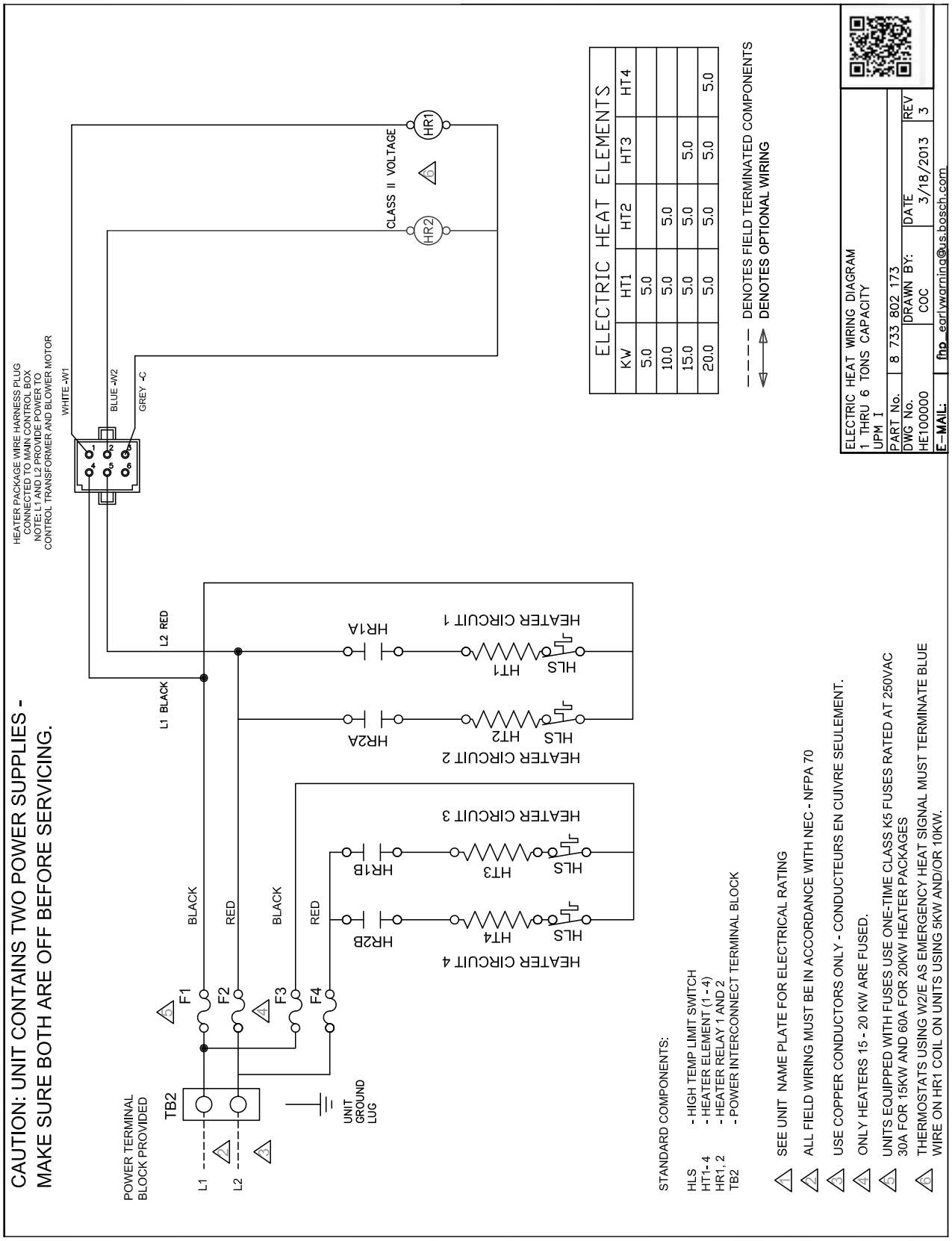

Figure # 35

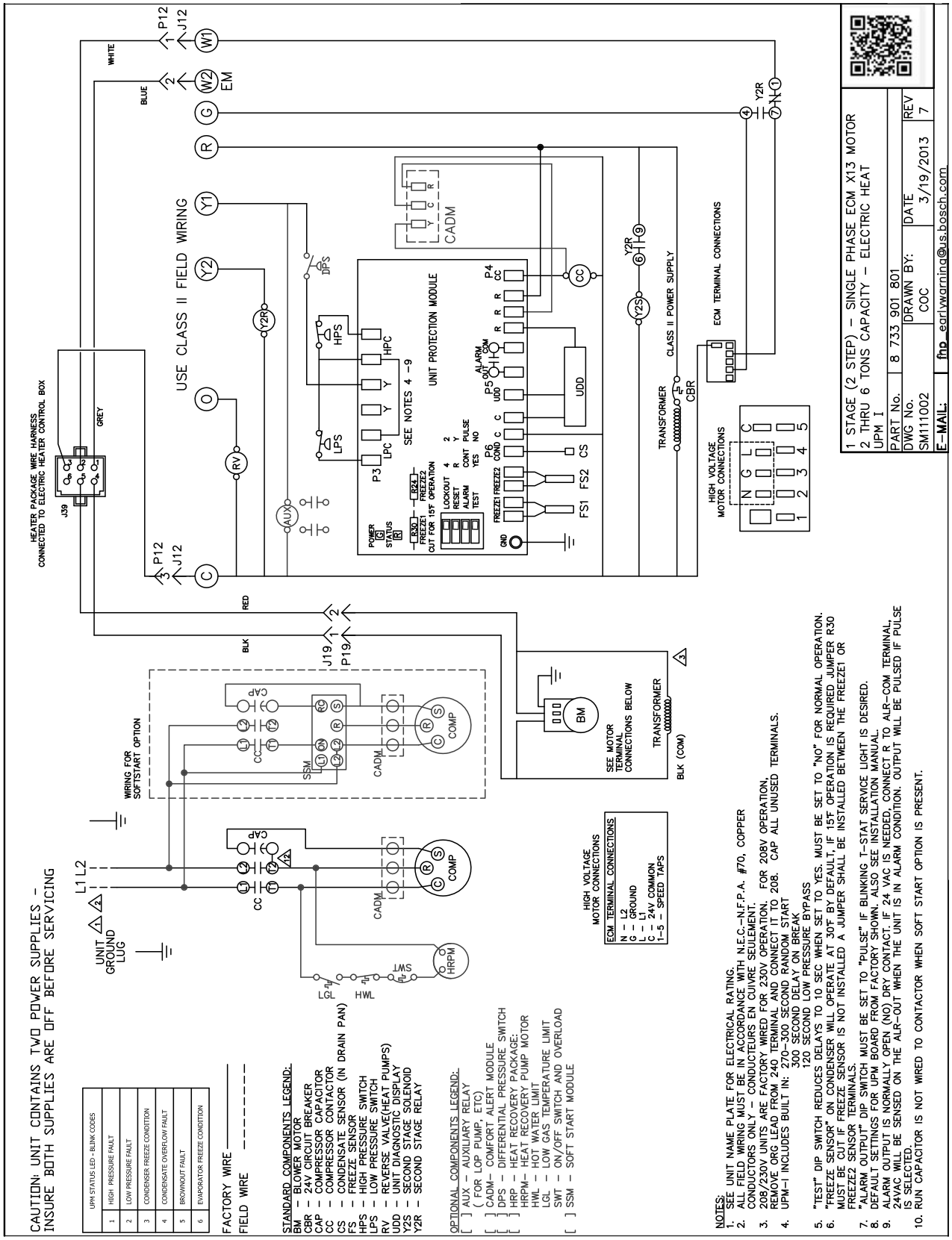
CAUTION: UNIT CONTAINS TWO POWER SUPPLIES -
INSURE BOTH SUPPLIES ARE OFF BEFORE SERVICING
UPM STATUS LED - BLINK CODES
1 HIGH PRESSURE FAULT
2 LOW PRESSURE FAULT
3 CONDENSER FREEZE CONDITION
4 CONDENSATE OVERFLOW FAULT
5 BROWNOUT FAULT
6 EVAPORATOR FREEZE CONDITION
FACTORY WIRE
FIELD WIRE
STANDARD COMPONENTS LEGEND:
BM - BLOWER MOTOR
CBR - 24V CIRCUIT BREAKER
CAP - COMPRESSOR CAPACITOR
CC - COMPRESSOR CONTACTOR
CS - CONDENSATE SENSOR (IN DRAIN PAN)
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
LPS - LOW PRESSURE SWITCH
RV - REVERSE VALVE(HEAT PUMPS)
UDD - UNIT DIAGNOSTIC DISPLAY
Y2S - SECOND STAGE SOLENOID
Y2R - SECOND STAGE RELAY
OPTIONAL COMPONENTS LEGEND:
[ ] AUX - AUXILIARY RELAY
(FOR LOP PUMP, ETC)
[ ] CADM- COMFORT ALERT MODULE
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
[ ] HRP - HEAT RECOVERY PACKAGE:
HRPM- HEAT RECOVERY PUMP MOTOR
HWL - HOT WATER LIMIT
LGL - LOW GAS TEMPERATURE LIMIT
SWT - ON/OFF SWITCH AND OVERLOAD
[ ] SSM - SOFT START MODULE
HEATER PACKAGE WIRE HARNESS
CONNECTED TO ELECTRIC HEATER CONTROL BOX
USE CLASS II FIELD WIRING
UNIT PROTECTION MODULE
SEE NOTES 4 -9
WIRING FOR SOFTSTART OPTION
HIGH VOLTAGE MOTOR CONNECTIONS
ECM TERMINAL CONNECTIONS
N - L2
G - GROUND
L - L1
C - 24V COMMON
1-5 - SPEED TAPS
SEE MOTOR TERMINAL CONNECTIONS BELOW
TRANSFORMER
CLASS II POWER SUPPLY
ECM TERMINAL CONNECTIONS
UNIT GROUND LUG
BLK (COM)
WHITE
BLUE
GREY
RED
BLK
NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY - CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE ORG LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
300 SECOND DELAY ON BREAK
120 SECOND LOW PRESSURE BYPASS
5. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
6. "FREEZE SENSOR" ON CONDENSER WILL OPERATE AT 30°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED JUMPER R30 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE1 OR FREEZE2 SENSOR TERMINALS.
7. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
8. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
9. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR-COM TERMINAL. 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
10. RUN CAPACITOR IS NOT WIRED TO CONTACTOR WHEN SOFT START OPTION IS PRESENT.
1 STAGE (2 STEP) - SINGLE PHASE ECM X13 MOTOR
2 THRU 6 TONS CAPACITY - ELECTRIC HEAT
UPM I
PART No. 8 733 901 801
DWG No. SM111002
DRAWN BY: COC
DATE 3/19/2013
REV 7
E-MAIL: fhp_earlywarning@us.bosch.com

Figure # 36

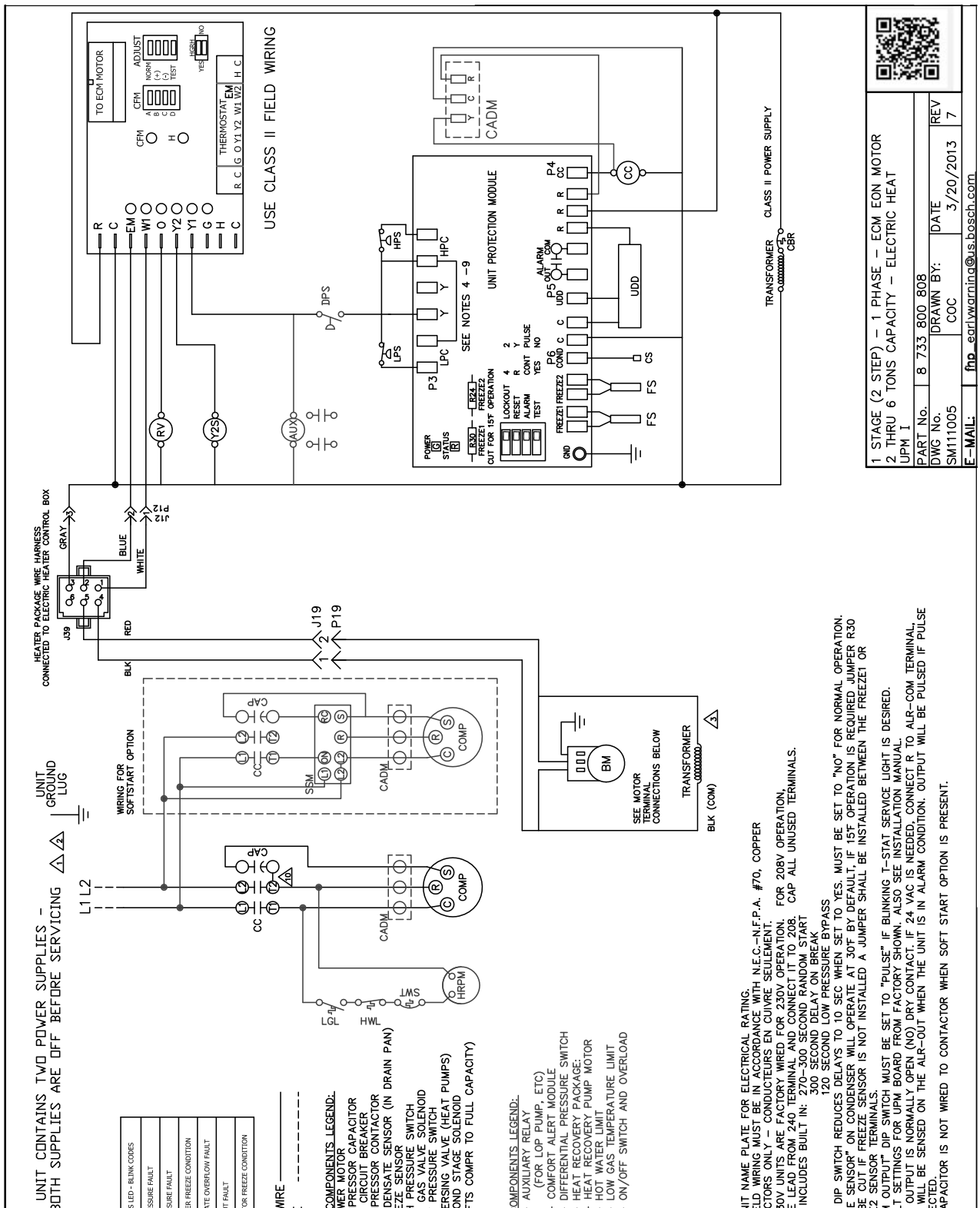
CAUTION: UNIT CONTAINS TWO POWER SUPPLIES -
INSURE BOTH SUPPLIES ARE OFF BEFORE SERVICING
FACTORY WIRE
FIELD WIRE
STANDARD COMPONENTS LEGEND:
BM - BLOWER MOTOR
CAP - COMPRESSOR CAPACITOR
CBR - 24V CIRCUIT BREAKER
CC - COMPRESSOR CONTACTOR
CS - CONDENSATE SENSOR (IN DRAIN PAN)
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HGV - HOT GAS VALVE SOLENOID
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE (HEAT PUMPS)
Y2S - SECOND STAGE SOLENOID (SHIFTS COMPR TO FULL CAPACITY)
OPTIONAL COMPONENTS LEGEND:
[ ] AUX - AUXILIARY RELAY (FOR LOP PUMP, ETC)
[ ] CADM- COMFORT ALERT MODULE
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
[ ] HRP - HEAT RECOVERY PACKAGE:
[ ] HRPM- HEAT RECOVERY PUMP MOTOR
HWL - HOT WATER LIMIT
LGL - LOW GAS TEMPERATURE LIMIT
SWT - ON/OFF SWITCH AND OVERLOAD
UPM STATUS LED - BLINK CODES
1 HIGH PRESSURE FAULT
2 LOW PRESSURE FAULT
3 CONDENSER FREEZE CONDITION
4 CONDENSATE OVERFLOW FAULT
5 BROWNOUT FAULT
6 EVAPORATOR FREEZE CONDITION
NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY - CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
300 SECOND DELAY ON BREAK
120 SECOND LOW PRESSURE BYPASS
5. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
6. "FREEZE SENSOR" ON CONDENSER WILL OPERATE AT 30°F BY DEFAULT, IF 15°F OPERATION IS REQUIRED JUMPER R30 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE1 OR FREEZE2 SENSOR TERMINALS.
7. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
8. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
9. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
10. RUN CAPACITOR IS NOT WIRED TO CONTACTOR WHEN SOFT START OPTION IS PRESENT.
1 STAGE (2 STEP) - 1 PHASE - ECM EON MOTOR
2 THRU 6 TONS CAPACITY - ELECTRIC HEAT
UPM 1
PART No. 8 733 800 808
DWG No. SM111005
DRAWN BY: COC
DATE 3/20/2013
REV 7
E-MAIL: fnp_earlywarning@us.bosch.com
USE CLASS II FIELD WIRING
TO ECM MOTOR
THERMOSTAT
UNIT PROTECTION MODULE
CADM
TRANSFORMER
CLASS II POWER SUPPLY
HEATER PACKAGE WIRE HARNESS CONNECTED TO ELECTRIC HEATER CONTROL BOX
WIRING FOR SOFTSTART OPTION
UNIT GROUND LUG
SEE MOTOR TERMINAL CONNECTIONS BELOW
SEE NOTES 4 -9
BLK (COM)

Figure # 37

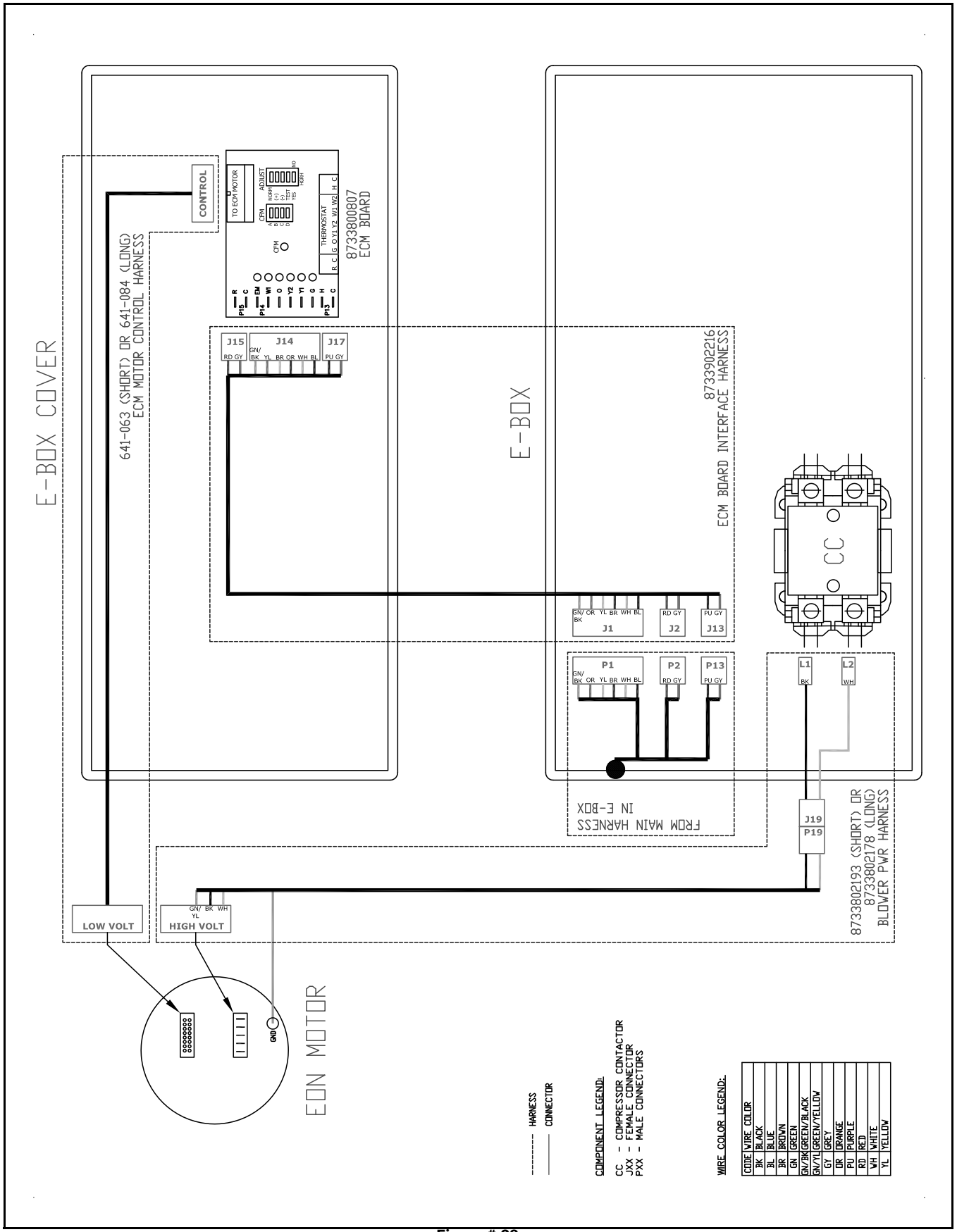
E-BOX COVER
641-063 (SHORT) OR 641-084 (LONG)
ECM MOTOR CONTROL HARNESS
CONTROL
TO ECM MOTOR
ADJUST
CFM
THERMOSTAT
R C G O Y1 Y2 W1 W2 H C
8733800807
ECM BOARD
J15 J14 J17
RD GY
GN/ BK YL BR OR WH BL
PU GY
E-BOX
8733902216
ECM BOARD INTERFACE HARNESS
J1 J2 J13
P1 P2 P13
L1 L2
BK
WH
CC
FROM MAIN HARNESS IN E-BOX
J19 P19
8733802193 (SHORT) OR
8733802178 (LONG)
BLOWER PWR HARNESS
LOW VOLT
HIGH VOLT
GN/ YL BK WH
ECM MOTOR
GND
HARNESS
CONNECTOR
COMPONENT LEGEND:
CC - COMPRESSOR CONTACTOR
JXX - FEMALE CONNECTOR
PXX - MALE CONNECTORS
WIRE COLOR LEGEND:
CODE WIRE COLOR
BK BLACK
BL BLUE
BR BROWN
GN GREEN
GN/BK GREEN/BLACK
GN/YL GREEN/YELLOW
GY GREY
OR ORANGE
PU PURPLE
RD RED
WH WHITE
YL YELLOW

Figure # 38

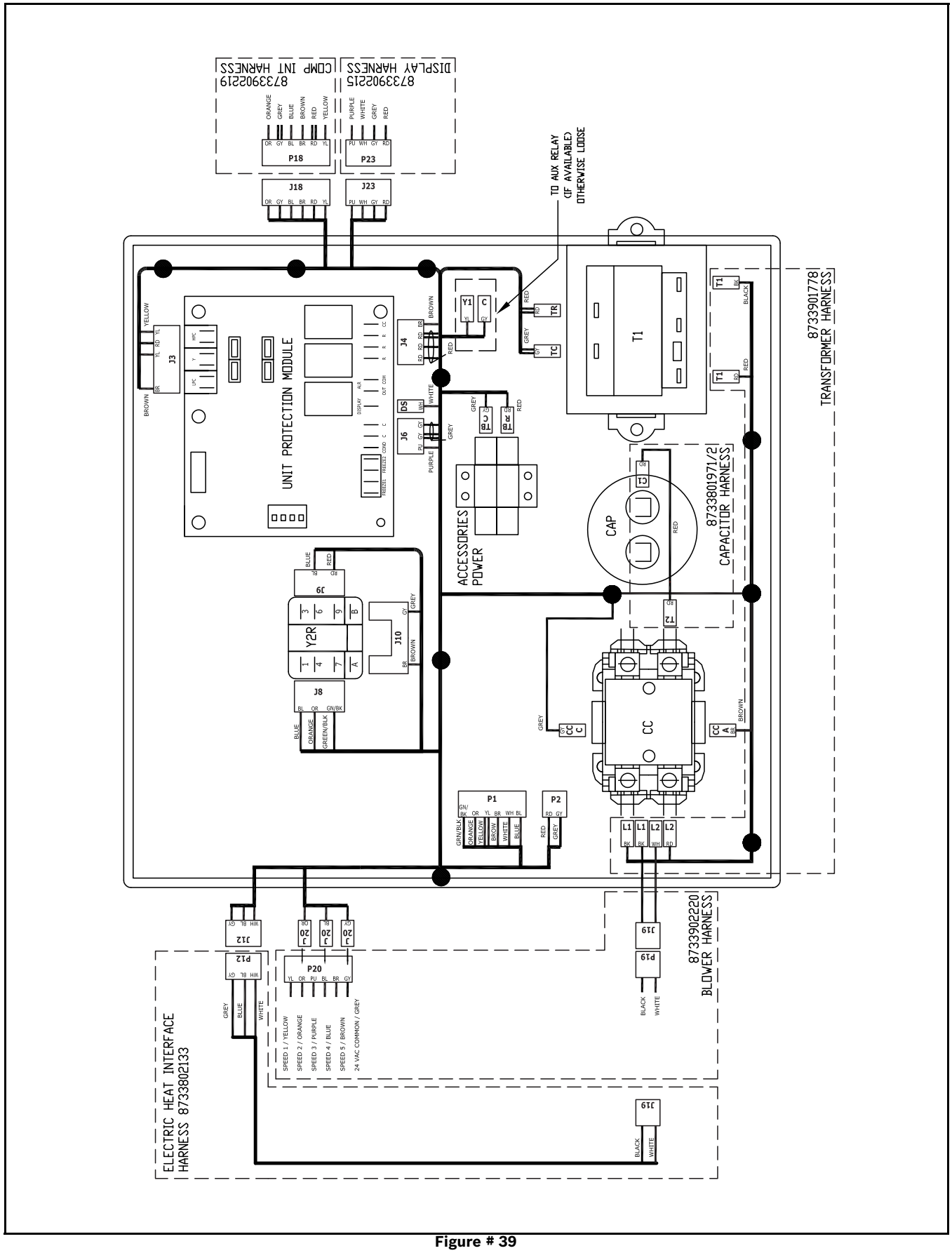
DISPLAY HARNESS
8733902215
COMP INT HARNESS
8733902219
P18
P23
J18
J23
TO AUX RELAY
(IF AVAILABLE)
OTHERWISE LOOSE
UNIT PROTECTION MODULE
J3
J4
J6
DS
Y1
C
TR
TC
T1
TB
PB
8733901778
TRANSFORMER HARNESS
ACCESSORIES
POWER
CAP
8733801971/2
CAPACITOR HARNESS
J9
Y2R
J10
J8
CC
P1
P2
L1
L2
J12
P12
P20
J19
P19
8733902220
BLOWER HARNESS
SPEED 1 / YELLOW
SPEED 2 / ORANGE
SPEED 3 / PURPLE
SPEED 4 / BLUE
SPEED 5 / BROWN
24 VAC COMMON / GREY
ELECTRIC HEAT INTERFACE
HARNESS 8733802133

Figure # 39

ELECTRIC HEAT ELECTRICAL DATA

			HEATER WATTS		HEATER AMPS		CIRCUIT	MCA		MOP	
MODEL	RATED kW	STAGE	240V	208V	240V	208V	FUSES	240V	208V	240V	208V
HK050-1201-RES	4.8	1	4,800	3,600	20.0	17.3	F1/F2	33.8	30.4	35	35
HK100-1201-RES	9.6	1	9,600	7,200	40.0	34.6	F1/F2	58.8	52.0	60	60
HK150-1201-RES	14.4	1	9,600	7,200	40.0	34.6	F1/F2	83.8	73.6	90.0	80.0
		1+2	14,400	10,800	60.0	51.9	F3/F4				
HK200-1201-RES	19.2	1	9,600	7,200	40.0	34.6	F1/F2	108.8	95.3	110	100
		1+2	19,200	14,400	80.0	69.2	F3/F4				

NOTES

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